

REQUEST FOR RECONSIDERATION

The claimed invention relates to a regeneration process of an etching solution, which contains an aqueous phosphoric acid solution and is used in etching silicon nitride films. In the process, a silicon compound (i.e., the reaction product between silicon nitride and phosphoric acid) is removed from the etching solution during and/or after etching treatment.

In particular, as recited in claim 1, the regeneration process is as follows:

A regeneration process of an etching solution composed of a phosphoric acid solution and used in etching silicon nitride films in an etch bath, which comprises the following steps:

taking said etching solution out of said etch bath, said etching solution containing a silicon compound formed by said etching, and adding water to said taken-out etching solution to lower a concentration of phosphoric acid in said etching solution to 80 to 50 wt.%; and

removing said silicon compound, which has precipitated in said etching solution by said lowering of said concentration of phosphoric acid, from said etching solution.

In conventional etching processes, a silicon compound that progressively accumulates in an etching solution cannot be practically captured, even when filtered. (See paragraphs [0002]-[0003] of the present specification). Moreover, the processes can be too cumbersome and not very cost efficient. (See paragraph [0004] of the present specification). In contrast, the claimed process permits an extremely efficient removal of the silicon compound, in which the compound is easily removed and the process is simplified. Such a process is not described or suggested by the prior art of record.

The rejection of claims 1-8 under 35 U.S.C. 103(a) as obvious over Yokomizo et al. (U.S. Patent No. 6,399,517) is respectfully traversed.

The reference to Yokomizo et al. does not describe or suggest the regeneration process of an etching solution of the claimed invention.

The reference generally describes a method of and an apparatus for etching. The etching method includes the steps of:

etching an object to be processed by immersing the object in an etching liquid stored in a process bath;

draining a predetermined amount of the etching liquid used in the etching step from the process bath while leaving the remaining amount of the etching liquid; and

supplying a new etching liquid into the process bath to add the new etching liquid to the remaining etching liquid.

(Column 2, lines 10-16) (Emphasis added). According to the reference,

since the predetermined amount of etching liquid used for the etching step is discharged while leaving a part of the liquid in the process bath and **the new etching liquid is supplied into the process bath, it is possible to shorten the time required for discharging and charging the etching liquid.**

(Id., lines 17-24) (Emphasis added). The “new etching liquid” is supplied from an “etching liquid reservoir”, in which the “new etching liquid” is supplied to an inner bath of the process bath via a supply line. (Column 4, lines 42-45).

Moreover, according to the reference,

It should be noted that when executing the etching process repeatedly, the Si concentration in the etching liquid E increases with the rising of concentration of both particles and oxides in the etching liquid E. However, **cleaning of the etching liquid E through the filter 23 and dilution of the etching liquid E due to the pure water from the pure water source 24 alone, are not sufficient to restrict the rising of concentration of both particles and oxides in the etching liquid E.**

(Column 7, lines 4-12) (Emphasis added). Therefore,

the new etching liquid is added into and mixed with the etching liquid E remaining in the inner bath 11. With the supplement, it is possible to control the Si concentration of the etching liquid E . . . the amount of particles in the etching liquid is not raised too much.

(Id., lines 48-55) (Emphasis added).

By contrast, in the claimed invention there is no need for such a cumbersome process of supplying a new etching liquid into the process bath to add to a remaining etching liquid.

In particular, the process of the present invention includes:

- (i) taking the etching solution out of the etch bath, the etching solution containing a silicon compound formed by the etching, and adding water to the taken-out etching solution to lower a concentration of phosphoric acid in the etching solution to 80 to 50 wt.% . . . ; and
- (ii) removing the silicon compound, which has precipitated in the etching solution by the lowering of the concentration of phosphoric acid, from the etching solution.

(Present specification at page 4, paragraph [0006]). According to the present specification at paragraph [0007], “[l]owering of the concentration of phosphoric acid to such a level significantly promotes the precipitation of the silicon compound in the etching solution, so that the efficiency of removal of the silicon compound is improved and the silicon compound precipitated in the etching solution can be efficiently filtered off.” However, as discussed above, in the process disclosed in the reference, filtering the etching liquid and *lowering the concentration of the etching liquid* alone are not sufficient remove particles and oxides in the etching liquid. Instead, part of the etching liquid must be drained and a new etching liquid mixed with the remaining etching liquid. Therefore, the claimed invention is clearly not obvious in view of the reference, since there is no evidence or suggestion to lower the concentration of the etching liquid to the range specifically recited in the present claims. Moreover, there is no motivation to completely modify the process disclosed in the reference, such that supplying a new etching liquid would not be necessary, since the reference clearly recites that the new etching liquid is required.

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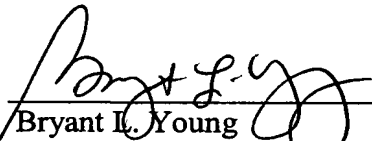
In view of the foregoing reasons, Applicants respectfully request the withdrawal of the rejection under 35 U.S.C. § 103 (a).

Applicants submit that their application is now in condition for allowance. Early notification of such allowance is earnestly solicited.

Respectfully submitted,

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